ARGUMENTS

Responding in turn to the points in the Examiner's communication:

1. Section headings have been added to the specification as requested.

2. Figure 1 has been amended as requested.

3. The Examiner has rejected Claim 4 as being anticipated by Kieu et al. (U.S. 6,181,382). This rejection is respectfully traversed.

It is considered helpful first to review the disclosure of Kieu:

Kieu discloses a HDTV up converter which includes a de-interlacer employing directional interpolation based on a detected slope. The de-interlacer uses a combination of pure temporal interpolation and steered spatio-temporal interpolation. The spatio-temporal interpolation uses a vertical temporal half-band filter, which may be rotated at one of ten possible angles (shown in Fig. 3) according to the detected slope.

The embodiments of the invention recognize that rotation of filters as described in the above reference is sensitive to errors in slope detection, and for shallow slopes will often require a very large filter aperture (e.g., 32 pixels wide in Kieu). Thus, for example, the subject matter defined in Claim 4 provides a set of three different spatial filter apertures, one of which is selected according to a measured slope and by comparing a measured slope with positive and negative thresholds, thereby providing simple and accurate detection and processing.

The inventors have recognized that, counter-intuitively, by providing only a single positive aperture, and only a single negative aperture, and by processing any and all slopes measured to be in excess of the relevant threshold by the single respective slope aperture, accurate and reliable results can be simply obtained.

Turning to the specific points raised by the Examiner:

The Examiner states that Kieu discloses a slope detector and a spatial filter having positive aperture (Fig. 5), a linear aperture (Fig. 7), and a negative aperture (Fig.6).

It is respectively submitted, however, that Figures 5 and 6 show edge direction calculators (Col. 6, lines 33-35) which form part of the edge direction detector (or slope detector). It is unclear exactly which of the features of Figures 5 and 6 are considered to equate to "a positive filter aperture" and "a negative filter aperture" respectively. However, in order to provide a reasoned response it will be assumed that the Examiner is referring to the series of filters 110 to 126. These filters are not selectively employed, and each filter operates continuously on a fixed one of the nine input signals 82[a-i]. Furthermore, these filters cannot be employed in response to detection of a slope since it is these very filters which provide detection of the slope.

Figures 5 and 6 cannot, it is submitted, therefore be considered as the spatial filter apertures recited in Claim 4, which are selectively employed upon detection of slope.

Considering Figure 7 referenced by the Examiner, this shows a high frequency detector (Col. 6, lines 36-37) which outputs a binary indicator of the presence of a vertical high frequency component. Again this operates continuously on a vertically interpolated input 82a, and not in response to any slope detection. It is therefore submitted that Figure 7 cannot be considered as the linear filter aperture recited in Claim 4.

It is noted that in point four of the communication the Examiner asserts that a filter having exactly three different apertures would be an obvious design choice, however it is considered appropriate to deal with this objection here. This assertion is respectfully traversed as will be explained.

U.S. 5,003,618 to Meno et al. (cited in point four of the communication) teaches processing using an anisotropic filter angularly oriented as a function of the distribution of picture values under the kernel. In the preferred example the filter can be rotated to one of eight different angular orientations, at 45 degree spacings (Col. 2, lines 31-33). It is noted

that the Examiner considers Meno to disclose four different filter kernels as Figs. 2, 3, 7, and 8. However, it is respectfully submitted that these figures in fact show a first and second example of a filter which can be rotated, a gradient kernel used in slope detection, and a rotated version of the kernel of Figure 3 respectively. Meno also teaches (Col. 2, lines 43-46) that in addition to the orientation of the filter the filter function itself may be selected based on the detected slope. Thus, the total number of filter configurations is multiplied further.

As mentioned above, Kieu discloses a large number of apertures, (or an aperture, which can be oriented at a large number of different angles). This results in a system in which a slope is detected to indicate one of nine possible inclinations, angles being discriminated by as little as 3 degrees in cases. The final interpolation method chosen then depends not only on this detailed slope calculation, but also on a 'mix' indicator which may result in combinations of filter orientations, yielding a total of 13 possible interpolation filter configurations.

This prior art discloses upwards of eight possible filter configurations and seeks to solve the problem of slope processing by highly adaptive processes using multiple criteria in an attempt to select, from the large number of possible apertures, the most appropriate. This teaching is divergent with the present invention as recited in Claim 4, which simply but ingeniously uses only three filter apertures and two slope thresholds, for processing of all possible slopes.

It is therefore considered that Claim 4 is novel and inventive over the cited art.

4. The Examiner has rejected Claims 1, 2, 5 and 6 as being obvious over the combination of Kieu et al. (U.S. 6,181,382) with Meno (U.S. 5,003,618). This rejection is respectfully traversed. Amendments have nonetheless been made to distinguish the claimed invention still more clearly from the art. Basis for the amendments to Claim 1 can be found for example on page 6, lines 4 to 6.

Considering Meno briefly, there is disclosed an adaptive spatial anisotropic digital filtering method in which a filter kernel is oriented according to the distribution of the pixel values under the kernel.

Claim 1 provides a set of spatial filter apertures selected such that the weightings for each of the set of spatial filter apertures sum to unity over a line including the current pixel and sum to zero on each side of the said line. In other words, the weightings on one side of that line sum to zero and the weightings on the other side of that line also sum to zero. This has the advantage that shallow slopes can be accommodated using a small aperture.

The Examiner considers that Meno discloses automatic adaptive filtering wherein the weightings sum to unity over a vertical line and the weightings on either side sum to zero. It is respectfully submitted that this is not in fact the case.

The Examiner cites Figures 2 and 8 of Meno. In the aperture of Figure 2, the weightings to the left of the vertical line sum to minus six, and the weightings to the right of the vertical line sum to plus six. Figure 2 therefore does not show a filter aperture where the weightings sum to unity over a line including the current pixel and sum to zero on each side either side of the said line, as required by Claim 1.

Turning to Figure 8, this shows the filter aperture of Figure 3 rotated through 45 degrees. This filter aperture only satisfies the conditions of Claim 1 in the special case that it is aligned at 45 degrees from the vertical. Nowhere in Meno are the particular weighting conditions of Claim 1 mentioned, nor is it even hinted that any significance should be attached to the particular configuration of Figure 8. It is submitted that this particular instance of a filter aperture rotated through a particular angle cannot be considered equivalent to the feature of Claim 1 which requires the weightings of each of a set of (fixed) spatial filter apertures to sum to unity over a line including the current pixel and sum to zero on each side either side of the said line.

The Examiner considers that it would have been obvious to combine the weightings taught by Meno with the video processing apparatus taught by Kieu. Again, the applicant respectfully disagrees.

The apparatus of Kieu is directed to standard video to HDTV conversion. The particular passages relied on by the examiner refer to interpolation of video lines. Meno teaches a method of anisotropic digital filtering. In particular, the filter of Figures 3 and 8 performs low pass filtering in one direction and high pass filtering in another, for enhancing

line definition in an image. Therefore, the two citations relate to different technical applications.

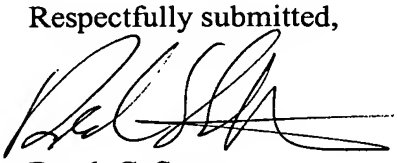
Digital filter weightings are application specific, and may even be specific, or at least optimized, within a particular application. There would be no motivation for the skilled person to substitute into an interpolator, the filter weightings from a line enhancer; indeed this would most likely cause the interpolator to fail, or at least result in significantly poorer performance. Even if the skilled person were to consider the teachings of Meno in association with those of Kieu, there is no particular incentive to pick the particular filter of Figure 3, and even less to consider the particular orientation shown in Figure 8. It is therefore considered that it would not be obvious to combine the teachings of these two documents, and that even if they were combined, they would not result in the claimed subject matter.

It is therefore considered that Claim 1 is novel and inventive over the cited art, either alone or in combination.

Claims 2, 3, 5 and 6 are considered novel and inventive at least by virtue of their dependency on Claims 1 and 4 respectively.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



Derek C. Stettner
Reg. No. 37,945

Docket No.: 087805-9025-00
Michael Best & Friedrich LLP
100 East Wisconsin Avenue
Milwaukee, Wisconsin 53202-4108

(414) 271-6560

X:\clientb\087805\9025\A0834496.1